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Uses of radio-telemetry in quelea management

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Introduction

Radio-telemetry is a technique that is increasingly being used to investigate various aspects of the behaviour of pest birds in relation to agricultural damage, crop protection, and management operations (Besser 1978; Bray 1973; Bray *et al.* 1975; Heisterberg *et al.* 1984; P. Lefebvre *et al.*, unpubl. data). The technique has proved useful to locate roosts and nesting colonies of quelea in Ethiopia (Bruggers *et al.* 1983) and of quelea and Golden Sparrows *Passer luteus* in Niger (R. Bruggers and J. Bourassa, unpubl. data), follow daily movement patterns and dispersal of Black-headed Weavers *Ploceus cucullatus* in Ethiopia (Bruggers *et al.* 1985), and assess the impact of lethal avicide sprays of colonies on non-target birds (Bruggers *et al.*, in press). In addition, telemetry would seem to have other uses in quelea management.

For effective control of quelea breeding colonies, it is important to locate the colonies during their early stages. This gives maximum time to determine if control is justified and, if so, to make appropriate preparations. The difficulties associated with locating quelea concentrations are described in Chapter 4. The logistics involved are formidable whether overland vehicle or low-flying aircraft survey methods are used, given the vastness of the quelea breeding range. Most colonies are located more than 2 weeks after their inception, when the grass nests have dried and their tan colour contrasts with the surrounding vegetation. In Tanzania during 1985, the average time elapsed between the time 25 colonies were initiated and located was 16 days (C. Elliott, pers. comm.). The Tanzanian Bird Control Unit even had the advantage of using a helicopter, yet only seven of the colonies were found within 1 week of installation. Thus, Bird Control Units usually are faced with the dilemma of trying to control many nesting colonies in the last 3 weeks before the birds disperse. This insufficient time can lead to poorly executed operations, low kills, and inadequate evaluation of results.

Surveys and nesting colony detection in Ethiopia

In Ethiopia in 1981, 1.8-g radio transmitters with a battery life of between 2.5 and 3.5 weeks and a reception distance of 4–8 km at survey altitudes of 300–700 m and 31 km at 1525 m (Bruggers *et al.* 1981a), were attached to the base of the tail of two quelea males prior to nesting, and to 17 additional birds during advanced stages of the nesting cycle. The location and movements of these 19 radio-equipped birds were monitored between 17 May and 28 June in the Weyto and Sagon River valleys in the Rift Valley of south-western Ethiopia, using a Bell 47 helicopter.

Six quelea breeding colonies had been located there during 1979 and 1980 using about 50 h of helicopter time during several weeks of ground and aerial survey. Because of the remote, extensive area associated with the Weyto and Sagon rivers (*c.* 1200 km²) and the Omo River (*c.* 2775 km²), approximately 160 h of helicopter time costing US \$350–550/h had been needed for the 1981 survey and related field activities. Less expensive fixed-wing aircraft were inappropriate for this area because of the absence of landing strips and the need to work in the nesting colonies. Roads were nearly non-existent in the area.

The two males that had been mist-netted on 17 May from a pre-nesting feeding flock and radio-equipped were relocated on 21 May during 2 h of aerial surveying in a 2-day-old 12.4-ha nesting colony of more than 1 million birds. This colony was only 0.5 km from a smaller, 0.40-ha colony in which the birds were fledging and which had been overlooked during the initial 10 h of pre-radio-tracking surveys of the valley. During the next 2 weeks, these two males (which did not nest, probably because of the radio package) travelled at least 25 km and were tracked to two other colonies, that were again only 2–3 days old. Four colonies were, therefore, located via the radio-equipped males, three of them within 3 days of installation. In a situation in which control might have been necessary, a maximum of about 39 days would have been available for a full evaluation of the potential impact of the colonies on agriculture and to prepare and execute control.

The information on daily movement obtained from the 17 other quelea shows the usefulness of the technique in survey operations. Bruggers *et al.* (1983) found adults that were feeding nestlings usually did not travel more than 2–3 km from the colony and foraged in a few preferred areas. Therefore, aircraft survey transects would have needed to be flown at about 5-km intervals, and ground surveys would have had to pass within 3 km of the colony to have a chance of detecting it. Flying such close survey transects is both expensive and impractical. Ground surveys must also overlook many colonies if roads do not pass within 3 km of the colony sites.

Post-spray behaviour

The behaviour of quelea after spraying influences efforts both to estimate control success and to evaluate the potential impact that dead or dying birds might pose to non-target wildlife. Elliott (1981b) reported that although the majority of quelea die within a few hours of a fenthion application, a few can take up to 24 h to die and some can be found dead up to 5 km from the spray site. Mortality estimates may, therefore, need to take deaths outside the spray site into account. The presence of dead and dying birds some distance from spray sites may also affect a much larger population of non-target wildlife, particularly raptors, than had been previously thought.

Radio-telemetry was one of the principal techniques used to investigate these problems in a study carried out in Kenya in 1985 (Bruggers *et al.*, in press). Twenty quelea were fitted with 1.1-g radio transmitters at two breeding colonies which were then sprayed (Plate 6a,b). Radio transmitters (some equipped with mortality sensors) were also attached to eleven Tawny Eagles *Aquila rapax*, three Bateleurs *Terathopius ecaudatus*, four Pale Chanting Goshawks *Melierax poliopterus*, two Gabar Goshawks *M. gahar*, two Pygmy Falcons *Poliohierax semitorquatus*, two Pearl-spotted Owlets *Glaucidium perlatum*, two Laughing Doves *Streptopelia senegalensis*, two Ring-necked Doves *S. cupicola*, and one Taita Fiscal *Lanius dorsalis*. In addition, seven Black-backed Jackals *Canis mesomelas* and one Common Genet *Genetta genetta* were radio-equipped.

The radio-telemetry data showed that many raptors are highly mobile, are attracted to sprayed quelea colonies, and will sequentially predate colonies as the availability of young increases. In this manner, they are likely to suffer increasingly greater cholinesterase (ChE) depression and ultimately death. The fate of most of these birds other than the raptors is unknown because of the absence of mortality sensors in their transmitters. Most data produced by the radio-equipped quelea were inconclusive. However, several radio-equipped quelea apparently died outside of the colonies, one as far as 11 km away. Radio-telemetry made an important contribution to this study and would be a necessary component of any follow-up studies.

Additional management implications

Locating roosts

The ability of quelea to carry radio transmitters, and the success of these radio-telemetry efforts present other interesting uses related to increasing the efficiency and evaluating the effectiveness of control operations and crop protection efforts in Africa. One use may be the rapid location of roosts

containing birds causing damage to crops. Roosts, which are transient, unpredictable, often composed of several species, and often not detectable from the air, can be even more difficult to locate than nesting colonies (Ward 1979). Unless they are in traditional, known locations, considerable time (often more than 1 week) must be spent trying to locate them. By catching quelea in the fields being damaged, radio-equipping them, then tracking them at dusk to the roost by aircraft or vehicles, it may be possible to reduce the location time to only a couple of days. The roost found in this way would also be certain to include the birds directly involved in the damage. This kind of information was obtained in April 1987 for mixed roosts of radio-equipped quelea and Golden Sparrows in Niger (R. Bruggers and J. Bourassa, unpubl. data).

It is possible that this technique would be particularly useful where damage is being caused by birds roosting in areas of rough or swampy terrain. Roosts near irrigated rice fields are often in small sections of large reed beds (as in Mozambique [M. Jaeger, pers. comm.]), in stands of sugar-cane (as in Kenya [C. Elliott, pers. comm.]), or on islands (as in Niger [R. Bruggers, pers. obs.]), but the control officer has great difficulty in locating the precise patch where the roost is situated. As a result, it is sometimes necessary to spray the whole stand of reeds or sugar-cane in order to achieve control. In such circumstances, radio-telemetry would not only locate the roost more quickly, but also help to define its precise dimensions, thereby reducing the amount of chemical needed for control. Likewise, because considerable roost interchange can occur (Heisterberg *et al.* 1984; R. Bruggers and J. Bourassa, pers. obs.), additional roosts could possibly be found by tracking radio-equipped birds.

Evaluating crop protection efforts

The technique of radio-telemetry might also be useful in evaluating the effectiveness of chemical repellents. Dyer and Ward (1977) suggested that birds repelled from one crop area might move to another and damage crops. By incorporating the techniques of radio-telemetry with repellent applications, the behaviour of the pest birds can be better understood. For example, Besser (1978) and Besser *et al.* (1979), using radio-equipped Red-winged Blackbirds *Agelaius phoeniceus*, found that on 43 per cent of 56 occasions, flocks frightened from vulnerable sunflower fields next fed in stubble fields, weed patches, non-vulnerable sunflowers, corn fields, and swathed wheat; 27 per cent of the flocks visited vulnerable cornfields, but inflicted only negligible damage. Radio-telemetry could be similarly used in African bird pest damage situations to determine the movements of repelled birds and understand the relationship of alternative food sources and adjacent cropping areas to the outcome of crop protection efforts.

Conclusions

The use of radio-telemetry in studies of quelea (and other African bird pests) has important implications for future investigations. The information that could be collected on local daily movements could improve our understanding of the quelea's crop-damaging behaviour. The use of the technique to locate roosts and colonies at early developmental stages, could greatly increase the efficiency of survey and control operations. Although radio transmitter weight may not decrease much below 1.0 g for some time, it is possible that further technological advances will be made that will permit the reception distance to be increased, the battery life to be extended, and the overall reliability to be improved (L. Kolz, pers. comm.), characteristics that will increase field effectiveness. However, radio-telemetry techniques must be used in the context of a well-defined avian agricultural problem to achieve their maximum potential.

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